and the tables which I have given show that nebulæ, bright-line stars, stars with mixed flutings, and the aurora have spectra closely resembling those of comets, and are therefore probably also meteoritic phenomena.

## II. "The Presence of Bright Carbon Flutings in the Spectra of Celestial Bodies." By J. Norman Lockyer, F.R.S. Received November 23, 1889.

One of the chief conclusions arrived at in my former papers was that not only the nebulæ but many of the so-called stars are really sparse groups of meteorites, the latter only differing from the former by the fact that they are more condensed. I also pointed out that if this conclusion were correct the spectra of both these classes of bodies should approximate to those of comets, in which carbon radiation is one of the chief features, while their meteoritic nature is generally accepted. Since those papers were written a further inquiry has been made, both by looking through the records of past observations, and by additional observations at Kensington and Westgate, with a view of gaining more information as to the presence or absence of bright carbon flutings in the spectra of nebulæ and stars.

Certain results have already been obtained which I think sufficiently interesting to communicate to the Society. Before these observations were made, I suggested that some of Vogel's observations might be interpreted to signify bright carbon, but there was then a little doubt as to the existence of the bright flutings in the stellar spectra, as their presence was only suggested in some cases by slight rises in the light curves.

The following is a list of the bodies which contain either one or both of the carbon flutings near 517 and 468—474, the latter being a group of flutings, which, as I have before shown,* sometimes has its point of maximum brightness shifted from 474 to 468. The fluting near 564 has been omitted from the table, as it is generally masked, either by continuous spectrum or by the superposition of the fluting of manganese near 558. The wave-lengths given are as measured by the various observers stated.

The spectrum of the aurora is added for the sake of completeness.

It will be seen from the table that the record of the presence of carbon is unbroken from a planetary nebula through stars with bright lines to those resembling $\alpha$ Herculis, *i.e.*, entirely through Groups I and II of my classification.

* 'Roy. Soc. Proc.,' vol. 35, p. 167.

| Name. | Fluting 468--474. | Fluting 517. | Reference. |
|---|---|---|---|
| Planetary nebula | 469·4 (Copeland) | .. .. | 'Copernicus,' vol. 1, p. 2. |
| Nebula in Orion | 470 (Taylor) | .. .. | 'Monthly Notices,' vol. 49, p. 126. |
| Nebula, Gen. Cat., No. 4373 | .. .. | 518 (Vogel) | 'Bothk. Beob.,' Leipzig, Heft 1, 1872, p. 57. |
| ,, ,, ,, 4234 | .. .. | 518 (Vogel) | ,, ,, ,, ,, ,, |
| ,, ,, ,, 4390 | .. .. | 518 (Vogel) | ,, ,, ,, ,, p. 58. |
| Nebula in Andromeda | 468—474 (Fowler) | 517 (Fowler) | 'Roy. Soc. Proc.,' vol. 45, p. 216. |
| ,, ,, | .. .. | 517 (Taylor) | 'Monthly Notices,' vol. 49, 126. |
| $\gamma$-Argus | 468 (Ellery) | .. .. | 'Observatory,' vol. 2, p. 418. |
| ,, | 464·6 (Copeland) | .. .. | 'Copernicus,' vol. 3, p. 205. |
| Arg.-Oeltzen, 17681 | 461—470 (Vogel) | .. .. | 'Astro-Phys. Obs. zu Potsdam,' vol. 4, No. 14, p. 16. |
| ,, ,, | 473 (Pickering) | .. .. | 'Astr. Nachr.,' No. 2376. |
| Lalande, 13412 | 469 (Vogel) | .. .. | 'Astro-Phys. Obs. zu Potsdam,' vol. 4, No. 14, p. 17. |
| 1st Cygnus | 470 (Wolf and Rayet) | .. .. | 'Comptes Rendus,' vol. 65, p. 292. |
| ,, | 465—470 (Vogel) | .. .. | 'Astro-Phys. Obs. zu Potsdam,' vol. 4, No. 14, p. 17. |
| ,, | 468—474 (Fowler) | 517 (Fowler) | New observations. |
| 2nd Cygnus | 470 (Wolf and Rayet) | .. .. | 'Comptes Rendus,' vol. 65 (1867), p. 292. |
| ,, | 464 (Vogel) middle of band. | .. .. | 'Astro-Phys. Obs. zu Potsdam,' vol. 4, No. 14, p. 17. |
| ,, | 468—474 (Fowler) | 517 (Fowler) | New observations. |
| 3rd Cygnus | 470 (Wolf and Rayet) | .. .. | 'Comptes Rendus,' vol. 65 (1867), p. 292. |
| ,, | 461—468 (Vogel) | 517 (Vogel) | 'Astro-Phys. Obs. zu Potsdam,' vol. 4, No. 14, p. 292. |
| ,, | 468—474 (Fowler) | 517 (Fowler) | New observations. |
| $\gamma$-Cassiopeiæ | .. .. | 517 (Sherman) | 'Astr. Nachr.,' No. 2691. |
| ,, | 468—474 (Fowler) | 517 (Fowler) | New observations. |
| $o$-Ceti | 468—474 (Fowler) | 517 (Lockyer and Fowler) | New observations. |
| $\alpha$-Herculis | 468—474 (Fowler) | 517 (Lockyer and Fowler) | New observations. |
| $\alpha$-Orionis | .. .. | 517 (Lockyer and Fowler) | New observations. |
| Aurora | 474—478 (Vogel) | .. .. | 'Bothk. Beob.,' Leipzig, Heft 1, 1872, p. 43. |
| ,, | .. .. | 517 (Backhouse) | 'Nature,' vol. 7, p. 463. |

I should add that Mr. Fowler has glimpsed a line less refrangible than that at 500 in the spectrum of the ring nebula in Lyra. If this should turn out to be the carbon fluting at 517, it would seem that in that nebula we may have a state of condensation between those represented by the nebulæ of Orion and Andromeda, the carbon replacing the $\lambda$ 500 fluting of magnesium in the nebulæ, as apparently happens in comets on their approach to perihelion.

III. "Some Observations on the Amount of Luminous and Non-luminous Radiation emitted by a Gas Flame." By Sir JOHN CONROY, Bart., M.A., Bedford Lecturer of Balliol College and Millard Lecturer of Trinity College, Oxford. Communicated by A. G. VERNON HARCOURT, LL.D., F.R.S. Received November 11, 1889.

[See page 55.]

IV. "On the Effects of Pressure on the Magnetisation of Cobalt." By C. CHREE, M.A., Fellow of King's College, Cambridge. Communicated by Prof. J. J. THOMSON, F.R.S. Received November 22, 1889.

(Abstract.)

It has long been known, from the classic researches of Dr. Joule, that a rod of iron free from stress increases in length when magnetised in a comparatively weak field. When, however, the strength of the field is continually raised, it has been found by Mr. Shelford Bidwell that the rod ceases to increase in length, and then shortens, so that in a sufficiently strong field the length becomes less than it was originally. It has also been found by Villari, Sir W. Thomson, and others that when a rod of iron is exposed to successive loadings and unloadings of a given weight in a magnetic field, there appears a corresponding cyclic change of magnetisation. In this cyclic change the maximum magnetisation occurs when the load is "on," or when the load is "off," according as the field is weaker or stronger than a certain critical field depending on the load, called by Sir W. Thomson the Villari critical field.

Cobalt has been found by Mr. Shelford Bidwell to shorten when magnetised in weak fields, but to lengthen in very strong fields. The field in which it ceases to shorten is very much higher than the field in which iron ceases to lengthen. Also in weak fields Sir W. Thomson has found the magnetisation of a cobalt rod under cyclic applications of tension to be least when the tension is "on."